Washington State Department of Transportation

American Public Works Association
Washington State Chapter

Technical Commentary
for
Standard Plan B-23a
Manhole Type 1

General Information

Background: Manholes primarily serve as junctions for storm or sanitary sewer systems when a change in horizontal or vertical alignment must occur. Manholes can also serve as access points to the pipe system for maintenance purposes. Manholes differ from catch basins in that the overall maximum depth is greater and there is no sump provided below the outlet pipe invert.

A Type 1 manhole should be specified when the pipes entering the manhole meet the requirements specified in Table 1 or when the manhole depths are within the parameters shown on the plan.

Manhole Depth: A maximum depth of 20 feet is specified in order to comply with Department of Labor and Industries ladder safety regulations. Manholes that exceed this depth must be designed with an appropriate safety feature, such as a landing platform or ladder safety device. Ladder safety requirements are outlined in WAC 296-155-480 and WAC 296-24-810.

The structural design of the bottom slab was developed using a manhole depth of 25 feet. If this depth is exceeded, the designer should investigate the need for increasing the thickness of the slab or increasing the amount of steel reinforcement in the slab.

The minimum depth of a Type 1 manhole is specified as 8 feet. This is a result of the typical dimensions of a base section (4 ft), an eccentric cone (3 ft) and any adjustment sections ($\pm$ 1 ft). If the 8 foot depth cannot be achieved, a Type 3 manhole should be specified.

Maximum Pipe Size: The maximum pipe inside diameter (I.D.) that can be placed in a Type 1 manhole is shown in Table 1. The maximum I.D. is dependent on the diameter of the manhole, the maximum knockout size, and the outside diameter of the pipe entering the manhole. The relationship between the inside diameter of the pipe and outside diameter of the pipe varies, depending on the pipe material used.

Table 1						
Manhole Diameter (in.)	Maximum Knockout (in)	Maximum Pipe I.D. for a Type 1 Manhole (in)				
		Concrete[1]	Metal[2]	HDPE[3]	Solid Wall PVC[4]	Profile Wall PVC[5]
48	36	24	30	24	27	30
54	42	30	36			36
60	48	36	42			42

1. Reinforced or plain
2. 2 2/3 x 1/2 or 3 x 1 corrugations, steel or aluminum.
3. High density polyethylene Stand Spec. 9-05.20. Not currently approved for storm sewer use in sizes larger than 24 in. I.D.
4. Solid wall polyvinyl chloride Standard Spec 9-05.12(1). Not currently produced in sizes larger than 27 in. I.D.
5. Profile wall polyvinyl chloride Standard Spec. 9-05.12(2). Maximum I.D. currently manufactured is 48 inches

If the inside diameter of the pipe to be used is larger than that shown in Table 1, a larger manhole, such as those shown on Standard Plan B-23b, must be provided. Standard Plan B-23b describes 72-inch and 96-inch manholes. Manholes are also available in diameters up to 144 inches and knockout sizes up to 120 inches, but the use of structures larger than 96 inches for highway drainage applications is very limited. As a result, manholes larger than 96 inches are not included in the Standard Plans.

It is recommended that a gap of approximately 1 to 2 inches be provided between the knockout wall and the outside of the pipe. The gap facilitates pipe installation into the manhole. Once the pipe is installed, the gap is filled with concrete grout.

Pipe Alternates: Most contracts allow a number of pipe alternates to be used. The designer must insure that the Type 1 manhole diameter specified for a location is large enough to accept all of the pipe alternates for that location.

Minimum Distance Between Knockouts: The minimum distance between knockouts provides enough wall area to keep the manhole intact during transit, installation, and backfilling. Manholes are particularly susceptible to damage when the knockouts are being removed in the field. Once the pipes have been installed and grouted into the manhole, much of the structural integrity is restored. If it is not possible to maintain the minimum distance between knockouts, a larger manhole diameter should be specified.

Base Sections: There are three different base sections that can be provided for a Type 1 manhole. The most common type is the precast base with integral riser walls. With this base section, the walls and base are formed and poured together, resulting in a monolithic section, typically 2 to 5 feet tall. Depending on the height, the base section may or may not contain the knockouts. Additional riser sections are placed on top of the base section to develop the full height of the catch basin.

The second type of base section is a precast base slab. The base slab is set in place and fit with an o-ring gasket. The o-ring gasket provides a watertight seal around the base to prevent leakage. A 2-foot riser section is typically placed first to form the sump. A 4 to 5-foot riser section containing the knockouts is placed next, followed by additional risers to develop the full height of the manhole basin.

The third type of manhole section is a cast in place slab. The slab extends 6 inches beyond the outside of the riser sections. A 2-foot riser section is typically placed first to form the sump. A grout fillet is placed on the outside of the joint between the base and riser. The fillet provides a watertight seal and also assists in holding the riser sections in place during installation. Additional riser sections are then placed on top of the base to develop the full height of the manhole.

Applicable Specifications

6-02.3	Construction Requirements for Concrete Structures
7-05	Manholes, Inlets, and Catch Basins
9-04.3	Joint Mortar
9-05.15(1)	Manhole Ring and Cover
9-12.4	Precast Concrete Manholes

Referenced Standard Plans

B-1z	Miscellaneous Details for Manholes and Catch Basins
B-25	Manhole Ring and Cover

Other Information

Standard Item Number: 3041

For a discussion on the lateral earth pressure that can develop around a manhole, see Chapter 5 of Concrete Pipe Handbook, American Concrete Pipe Association, 1988.

This commentary sheet is maintained by the Olympia Service Center Hydraulics Branch. Please send any suggestions for additions or modifications to :

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